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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/646,206	08/22/2003	Steffen Hornig	P2001,0122	9023
24131	7590	04/12/2005	EXAMINER	
LERNER AND GREENBERG, PA P O BOX 2480 HOLLYWOOD, FL 33022-2480			DOLAN, JENNIFER M	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 04/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/646,206	Applicant(s) HORNIG ET AL.	
	Examiner Jennifer M. Dolan	Art Unit 2813	

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The applicant claims “selecting the size of the nanocrystalline particles” with less than a quarter of a wavelength of 248, ..., UV exposure light.” It is unclear as to how the size of the particle is being chosen, and what is meant by selecting the size “with” less than a quarter wavelength of various exposure lights. The ‘plain English’ meaning of this claim language would indicate that somehow the particle size is physically selected by the exposure light, which clearly doesn’t make sense. Based on the applicant’s disclosure, it is assumed for the purposes of examination that “with” is intended to mean “to be” - i.e., the size of the particles are selected to be less than a quarter of a wavelength of 248 nm, etc. UV exposure light.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-5, 7-10, 12, 13, 16, 17, 20, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by European Patent Publication EP 0 744 662 to Kusumoto et al. (cited by applicant).

Regarding claims 1-3 and 20, Kusumoto discloses providing a semiconductor product (page 2, lines 5-14) and coating the product with an anti-reflective coating material formed of a matrix substance (page 3, lines 3-42; page 4, lines 22-30; polymeric materials) and of nanocrystalline particles (i.e. carbon or TiO) of a material different from the matrix substance (page 3, lines 17-30), the particles having a diameter of less than 100 nanometers, and thus absorbing light via the quantum size effect (page 3, lines 11-30).

Regarding claims 4, 12, and 13, Kusumoto discloses that the particle material can be titanium oxide (page 3, lines 17-20), which will intrinsically generate the additional energy levels within the band gaps of the matrix substance.

Regarding claim 5, Kusumoto discloses choosing a material of the particles, such as TiO or carbon, to effect absorption via the quantum size effect of a wavelength in the UV range (page 3, lines 10-30; page 5, lines 45-50).

Regarding claim 7, Kusumoto discloses choosing a material and concentration of particles for tuning a degree of absorption (page 3, lines 10-30; page 4, lines 7-11;

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column 6, line 50- column 7, line 4; Table 1 (page 10) shows that different compositions lead to different 'reflection preventing' properties).

Regarding claims 8 and 9, Kusumoto discloses choosing the matrix substance and particle size and concentration to tune the viscosity (see page 4, lines 7-11; page 7, lines 45-52; table 1) and the etch resistance of a dry etch process (page 7, lines 35-42; table 1).

Regarding claim 10, Kusumoto discloses that the matrix substance is an organic resin (page 3, line 30 – page 4, line 45; 'recipes' A-E on pages 8-9).

Regarding claim 16, Kusumoto discloses coating a layer to be patterned on a substrate with the anti-reflective coating to diminish the light reflection of exposure light (page 6, lines 35-60).

Regarding claim 17, Kusumoto discloses, prior to the coating step: providing the matrix material and the particles, and mixing them to form the coating material (pages 3-5, 8-9).

Regarding claim 21, Kusumoto discloses a resist layer on top of the anti-reflective layer (page 6, lines 35-45).

5. Claims 1-6, 10, and 16-20 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,744,293 to Okumura et al. (cited by applicant).

Regarding claims 1-3 and 20, Okumura discloses providing a semiconductor product (column 3, lines 1-25); and coating the semiconductor product with an anti-reflective coating material (14) formed of a matrix substance (column 3, lines 30-48) and of nanocrystalline particles (carbon particles) of a material different from the matrix

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substance (column 3, lines 48-57), the nanocrystalline particles having a diameter of less than 100 nm, and absorbing light via the quantum size effect (column 3, lines 47-65).

Regarding claims 4 and 5, Okumura discloses that the particles are carbon, which automatically creates additional energy levels within band gaps of the matrix (since the material is a semiconductor), thus allowing for absorption of a wavelength in the UV range (column 2, lines 37-60; column 3, lines 52-56).

Regarding claims 6, 18, and 19, Okumura discloses choosing the matrix substance, particle type, and particle concentration in order to adjust the refractive index relative to the refractive index of the resist layer (column 1, lines 40-46) and the semiconductor substrate, in order to allow for maximum light entrance (i.e. minimum reflection from) into the ARC material (column 2, lines 1-35; column 4, lines 1-9).

Regarding claim 10, Okumura discloses that the matrix is an organic resin (column 3, lines 30-48).

Regarding claim 16, Okumura discloses coating the substrate with the ARC material to diminish reflection of exposure light (see column 1, lines 40-60; column 2, lines 26-60).

Regarding claim 17, Okumura discloses prior to the coating step: providing the matrix material and nano-crystalline particles and mixing the materials to form the antireflective coating (column 3, lines 30-65; column 4, lines 1-20).

Regarding claim 21, Okumura discloses a resist layer on top of the ARC (column 4, lines 28-37).

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6. Claims 1, 10, and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,384,318 to Nomura.

Regarding claim 1, Nomura discloses providing a semiconductor product (column 1, lines 35-45); and coating the product with an anti-reflective coating formed of a matrix substance (organic or inorganic binder; see column 2, line 47-column 3, line 12) and nanocrystalline particles (silica particles) of a material different from the matrix substance (see column 2, line 47 – column 3, line 12), the particles being configured to absorb light via the quantum size effect (see column 13, lines 29-30; particles with a diameter of 0.05 microns – 0.3 microns would exhibit a quantum size effect).

Regarding claims 10 and 11, Nomura discloses that the matrix substance can be silicon oxide (column 3, lines 5-6).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 14 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kusumoto et al.

Kusumoto discloses that the particle concentration is about 3-20% by weight, which presumably falls within the 3-70% volume concentration specified in the claim.

Assuming arguendo, the 3-20% weight concentration does not intersect the 3-70% volume concentration range.

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify a particle concentration in Kusumoto in the 3-70% range. The rationale is as follows: A person having ordinary skill in the art would have been motivated to specify a volume concentration of 3-70%, because it would be necessary to provide sufficiently many particles to allow for the absorption of the light, yet few enough to retain the spin coating, etching, and index of refraction properties of the polymeric resin, as is appreciated by one skilled in the art. Although Kusumoto does not specify a volume concentration of 3-70%, it has been held that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (1955).

9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kusumoto et al. in view of European Patent Publication EP 0 770 579 to Yamada et al. (cited by applicant).

Kusumoto teaches an antireflective film using titanium oxide particles (see page 3, lines 17-21), but fails to teach a film using two different nanocrystalline particles.

Yamada teaches an antireflective film using nanocrystals of both titanium oxide and another metal oxide (page 5, lines 40-55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the ARC of Kusumoto by using a second metal oxide nanocrystalline particle, as suggested by Yamada. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use two different

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nanocrystalline particles, such as titanium oxide and another metal oxide, in the ARC, because doing so increases the photo-responsivity of the ARC as well as enhancing the form of the polymeric coating (see Yamada, page 5, line 19 – page 6, line 26).

Response to Arguments

10. Applicant's arguments filed 2/1/05 have been fully considered but they are not persuasive.

Regarding the 112 rejection, the Applicant argues that “the size” has antecedent basis from claim 2, and thus is clear and definite.

This is not persuasive, because claim 3 was not rejected on a lack of antecedent basis, but rather on a basis of grammatical clarity based on selecting the size of the particles with less than a quarter wavelength. Although “with” does not really have an equivalent meaning as “to be”, it would appear to the examiner that such an interpretation is the only one that provides a reasonable meaning to the claim. The Applicant is requested to clarify whether claim 3 is intended to read, “The method according to claim 2, which comprises selecting the size of the nanocrystalline particles **to be** less than a quarter of a wavelength of 248, 193, 157 or 127 nm of UV exposure light,” or whether the Applicant intends some alternate meaning or interpretation of this claim.

Regarding the presence of a “quantum size effect” in the structures in the Kusumoto, Okumura, and Nomura references, the Applicant argues that it is not merely the particle size that determines a quantum size effect, and that none of the references explicitly teach a quantum size effect. It is not clear whether the Applicant is also

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arguing that the combined particle material and size taught in Kusumoto, Okumura, and Nomura will not exhibit a quantum size effect.

These arguments are not persuasive. The Examiner does recognize that the material of the particle in combination with the size will determine whether quantum size effects will occur. The references in question teach the usage of TiO or carbon particles (Kusumoto), carbon particles (Okumura) and silica particles (Nomura). In fact, Kusumoto teaches a composition equivalent to one taught by the applicant, having an organic resin matrix and titanium oxide particles, where the particles are in the size range specified by the applicant as having quantum size effects, and where the particles are in the range of volume concentrations disclosed by the applicant (see page 8 of the specification of the present application). It is not readily apparent how the invention disclosed by Kusumoto having TiO particles in a resin binder differs from the structure of the Applicant, also having TiO particles in a resin binder, and thus, the structures are considered to have equivalent properties with respect to quantum size effects and energy level generation.

Furthermore, EP 0 770 579 to Yamada, which was cited by the Applicant, explicitly teaches that titanium oxide particles and semiconductor fine particles having a size of 100 nm or less will exhibit the quantum size effect (see Yamada, page 2, lines 1-15). Additionally, U.S. Patent Publication No. 2002/0186921 to Schumacher et al. and U.S. Patent Publication No. 2005/0061363 to Ginley et al. are cited herewith as providing evidence that carbon and silica fine particles with specified particle sizes will exhibit a quantum size effect. Specifically, Schumacher teaches that nanocrystals having a size of between 1-50 nm and made of group IV semiconductor materials or metal oxides, such as

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titanium oxide, silica, or carbon, will inherently exhibit quantum size effects (see Schumacher, paragraph 0036). Ginley similarly discloses that group IV nanocrystals having a size of less than 50 nm will inherently exhibit quantum size effects (see Ginley, paragraph 0032). Since Kusumoto teaches TiO or carbon particles having a size of 1-100 nm, Okumura teaches the use of carbon particles having a size of about 10 nm, and Nomura teaches silica particles having a diameter in a range including 50 nm (see column 13, lines 29-32), the layers in each reference would appear to be inherently “configured to absorb light via the quantum size effect” based on the material and size of the particles. The Applicant is politely reminded that the prior art references do not need to explicitly point out the presence of inherent features, and a person of ordinary skill in the art would not need to have recognized the inherent disclosure at the time of invention, but rather it is only required that the subject matter is in fact inherent in the prior art reference. *Schering Corp. v. Geneva Pharm. Inc.*, 339 F.3d. 1373, 1377, 67 USPQ2d 1664, 1668 (Fed. Cir. 2003).

The Applicant even further argues that Nomura does not disclose a semiconductor product, since there is no teaching of a semiconductor wafer or support.

This is not persuasive, because Nomura explicitly teaches that the device uses a semiconductor active layer and is formed with semiconductor materials (column 14, lines 30-40). It is respectfully pointed out to the Applicant that thin film devices using a semiconductor layer on a non-semiconductor substrate/layer or any devices made of semiconductor materials or using a semiconductor active region would constitute a “semiconductor product.”

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd



**CRAIG A. THOMPSON
PRIMARY EXAMINER**